

**Before the  
Federal Communications Commission  
Washington, DC 20554**

In the Matter of	)	
	)	
	)	
Ligado Networks LLC Request to Initiate a	)	
Rulemaking to Allocate the 1675-1680 MHz	)	RM-11681
Band for Terrestrial Mobile Use Shared with	)	
Federal Use	)	
	)	
	)	

**COMMENTS OF SNR WIRELESS**

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**COMMENTS OF SNR WIRELESS**

**I. INTRODUCTION AND SUMMARY**

SNR Wireless (“SNR”) respectfully submits these comments in response to the Ligado Networks (“Ligado”) proposal for terrestrial mobile downlink operations in the 1675-1680 MHz band (the “Ligado Proposal”).<sup>1</sup> The Ligado Proposal has serious consequences for the efficient use of the AWS-3 spectrum acquired recently in Auction 97, as well as critical federal government uses in nearby bands. These issues were not contemplated by Auction 97 bidders like SNR; and, if they had been, there likely would have been less demand for the spectrum and less auction revenue as a result. Moreover, unlike other proposals for commercial spectrum use that could impact federal spectrum users, the Ligado Proposal has not been considered by the Commerce Spectrum Management Advisory Committee (“CSMAC”), which includes broad representation of industry and government participants. In addition, if implemented, the

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<sup>1</sup> *LightSquared Subsidiary LLC Petition for Rulemaking to Allocate the 1675-1680 MHz Band for Terrestrial Mobile Use*, Petition for Rulemaking, RM-11681 (filed Nov. 2, 2012) (“*Ligado Petition*”); see also *Comment Sought to Update the Record on Ligado’s Request that the Commission Initiate a Rulemaking to Allocate the 1675-1680 MHz Band for Terrestrial Mobile Use Shared With Federal Use*, Public Notice, DA 16-443 (Apr. 22, 2016) (“*Ligado Public Notice*”).

proposal would require AWS-3 licensees to engage in costly and unanticipated interference mitigation and could negatively change the spectrum sharing parameters developed for AWS-3 licensees prior to Auction 97.

SNR urges the Federal Communications Commission (“FCC” or “Commission”) to seriously consider the negative implications of the Ligado Proposal for all licensees with unpaired AWS-3 spectrum, and these licensees’ legitimate investment-backed expectations, in assessing the Ligado Proposal. If the FCC adopts the Ligado Proposal, the 1675-1680 MHz licensees should bear all costs that result for AWS-3 or other affected licensees. Specifically, for the protection of AWS-3 licensees, the FCC should subject any future 1675-1680 MHz licensees to the same coordination and monitoring requirements imposed on AWS-3 licensees, including the obligation to engage with Federal users to secure approval to increase the interference budget, coordinate with Federal users through the CSMAC process, and engage in ongoing radio frequency (“RF”) monitoring.

## **II. BACKGROUND**

### **A. Ligado Proposal**

In 2012, Ligado filed a Petition with the Commission for a rulemaking to allow terrestrial mobile use of the 1675-1680 MHz band.<sup>2</sup> In December 2015, Ligado negotiated settlement agreements with certain Global Positioning Satellite (“GPS”) companies to resolve interference concerns raised by the GPS companies. Ligado then proposed license modifications consistent with those agreements and asked “that the Commission move forward with reallocation and

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<sup>2</sup> See *Ligado Petition*.

auction of the 1675-1680 MHz band, including license conditions that will permit the licensee to use that spectrum on a shared basis and in ways that accommodate the concerns of NOAA.”<sup>3</sup>

The Ligado Proposal was crafted as part of a larger reorganization of Ligado’s operations, which resulted from the settlement resolving potential incompatibilities between Ligado’s previously-envisioned operations and the operations of GPS providers.<sup>4</sup> The proposal and settlement included revised power limits and out-of-band emission requirements for Ligado’s operations in the 1627.5-1637.5 MHz and 1646.5-1656.5 MHz uplink bands. Ligado explained that it would voluntarily relinquish the right to conduct terrestrial downlink operations in the 1545-1555 MHz band. To replace its abandoned downlink spectrum, Ligado proposes to acquire (purportedly in a multi-bidder auction) the 1675-1680 MHz band for commercial downlink operations. It now seeks reallocation of that band for terrestrial mobile use as one step toward effecting this “comprehensive proposal.”<sup>5</sup>

In lieu of using 1545-1555 MHz, Ligado would use the 1675-1680 MHz band for terrestrial downlink operations in combination with the 1670-1675 MHz band, which is already allocated for terrestrial mobile use and already within Ligado’s control.<sup>6</sup> Ligado would also deploy terrestrially in the 1526-1536 MHz downlink band with lower power limits than currently allowed.<sup>7</sup>

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<sup>3</sup> See *Ex Parte* of New LightSquared, IB Docket No. 12-340; IB Docket No. 11-109; IBFS File Nos. SAT-MOD-20120928-00160; SAT-MOD-20120928-00161; SES-MOD-20121001-00872, at 1 (filed Dec. 31, 2015) (“*December Ex Parte*”).

<sup>4</sup> See *December Ex Parte*.

<sup>5</sup> *Id.*

<sup>6</sup> *Ligado Petition* at 7.

<sup>7</sup> See *Comment Sought on Ligado’s Modification Applications*, Public Notice, DA 16-442, at 2 (Apr. 22, 2016).

## **B. Auction 97**

In 2015, SNR Wireless acquired 244 AWS-3 licenses in Auction 97.<sup>8</sup> Of these, 150 licenses authorize SNR to conduct mobile uplink operations in the 1695-1710 MHz band (“AWS-3 uplink band”). Prior to Auction 97, the CSMAC’s Working Group 1 (“CSMAC WG1”) analyzed coexistence between the AWS-3 and federal operations, and developed protection criteria to ensure that commercial AWS-3 1675-1710 MHz licensees can share the 1675-1710 MHz band with existing federal users without causing harmful interference to the federal users.<sup>9</sup> The protection requirement and method of coordination were adopted prior to Auction 97 as section 27.1134(c) of the FCC’s rules.<sup>10</sup> Importantly, this analysis did not consider the effect of additional interference resulting from commercial downlink operations in the 1675-1680 MHz band, as proposed by Ligado.

## **III. DISCUSSION**

### **A. Ligado’s Proposed Use of 1675-1680 MHz Would Negatively Impact AWS-3 Licensees.**

The Ligado Proposal presents interference issues for both AWS-3 licensees in the 1695-1710 MHz band, including SNR, and federal government users, by frustrating the protection criteria carefully developed in anticipation of AWS-3 operations by CSMAC WG1. In addition, the 15 megahertz of separation between commercial downlink operations in 1675-1680 MHz and AWS-3 licensees’ commercial uplink operations in 1695-1710 MHz would create additional

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<sup>8</sup> See *Wireless Telecommunications Bureau Actions on AWS-3 Licenses in the 1695-1710 MHz, 1755-1780 MHz and 2155-2180 MHz Bands*, Public Notice, 30 FCC Rcd 11622 (2015).

<sup>9</sup> See *Final Report: Working Group 1 – 1695-1710 MHz Meteorological-Satellite*, Commerce Spectrum Management Advisory Committee (Jan. 22, 2013), available at [https://www.ntia.doc.gov/files/ntia/publications/wg\\_1\\_report.pdf](https://www.ntia.doc.gov/files/ntia/publications/wg_1_report.pdf) (“CSMAC Report”).

<sup>10</sup> 47 C.F.R. § 27.1134(c); see also *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, Report and Order, 29 FCC Rcd 4610 (2014).

unforeseen costs for AWS-3 licensees in the form of specialized device hardware and base station siting issues. Neither the Commission, nor any other authority, has considered these issues.<sup>11</sup>

Commercial licensees in the AWS-3 band share spectrum with federal users, and, as stated above, prior to the AWS-3 auction CSMAC worked diligently to develop recommended sharing criteria.<sup>12</sup> CSMAC WG1 was tasked with developing recommendations that would protect federal meteorological earth stations operating in the 1675-1710 MHz band from harmful interference due to commercial broadband operations in the 1695-1710 MHz band.<sup>13</sup>

Commercial AWS-3 licensees in the unpaired 1695-1710 MHz uplink band share spectrum with National Oceanic and Atmospheric Administration (“NOAA”), Department of Defense, and Department of Interior systems (hereinafter referred to as “Federal Users”) that receive data from Polar-orbiting Operational Environmental Satellites (“POES”) satellites.<sup>14</sup> The AWS-3 uplink band is also adjacent to frequencies used by the Federal Users to receive data from the current Geostationary Operational Environmental Satellites (“GOES”) satellites.<sup>15</sup> The current GOES system uses frequencies between 1673 and 1694.5 MHz. Thus, both the 1670-1675 MHz and

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<sup>11</sup> See *The Federal Communications Commission and the National Telecommunications And Information Administration: Coordination Procedures in the 1695-1710 MHz and 1755-1780 MHz Bands*, Public Notice, 29 FCC Rcd 8527 (2014) (setting coordination procedures for the 1695-1710 MHz band without consideration of Ligado’s proposals) (“AWS-3 Public Notice”). The *Ligado Public Notice* also did not request comment on these issues.

<sup>12</sup> See *CSMAC Report*.

<sup>13</sup> See *id.*

<sup>14</sup> See *Transition Plans and Transition Data for the 1695-1710 MHz Band*, NTIA (Oct. 29, 2015), available at <https://www.ntia.doc.gov/other-publication/2015/transition-plans-and-transition-data-1695-1710-mhz-band>.

<sup>15</sup> One of the GOES signals extends 250 kilohertz above the edge of the AWS-3 band at 1695 MHz, but the majority of GOES signaling occurs outside the AWS-3 band in an adjacent channel.

1675-1680 MHz bands are co-channel to frequencies used by the GOES system. Additionally, the first satellite to support the next generation of GOES, so-called “GOES-R,” will be launched later this year.<sup>16</sup> GOES-R uses more advanced and higher data rate signaling channels than legacy GOES, and requires a higher bandwidth channel, but this channel is similarly adjacent to the AWS-3 uplink band. The GOES-R frequencies are also directly adjacent to the 1675-1680 MHz band, and one of the GOES-R channels extends 300 kilohertz into that band, creating an overlap. Due to the national security importance of the data received from these satellites, the Federal Users’ GOES and POES receive facilities<sup>17</sup> need to be protected from both co-channel and adjacent channel interference.

The CSMAC WG1 process culminated in recommended protection distances around each identified meteorological earth station within which commercial AWS-3 operators in the 1695-1710 MHz band must coordinate spectrum usage with the Federal Users.<sup>18</sup> Coordination is based on a recommended interference threshold, which CSMAC WG1 calculated for each earth station based on each receiver’s specific technical characteristics.<sup>19</sup> In effect, this provides a maximum aggregate “interference budget” around each earth station that commercial AWS-3 operations in the 1695-1710 MHz band cannot exceed.

The Ligado Proposal contemplates a new nationwide deployment of base stations transmitting on a 10 MHz LTE channel in the 1670-1680 MHz band. This deployment would add significantly to the interference already expected to be received at Federal Users’ earth

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<sup>16</sup> *CSMAC Report* at 5.

<sup>17</sup> See 47 C.F.R. § 2.106, note US 88 for a list of the facilities to be protected.

<sup>18</sup> Coordination is required within the protection zones for devices with a maximum Effective Isotropic Radiated Power (“EIRP”) of 20 dBm or less. For devices with an EIRP of more than 20 dBm up to the maximum 30 dBm, coordination is required nationwide. See *CSMAC Report*.

<sup>19</sup> *CSMAC Report*, App. 7. Table 4 on 7-9 and 7-10 shows the interference protection criteria for each earth station.



stations. Ligado predecessor LightSquared commissioned reports from Alion to define protection zones for the Federal Users' earth stations within which Ligado envisions it would coordinate its base station deployments with the Federal Users.<sup>20</sup> But any Ligado base station deployment within these zones would necessarily consume a portion of the currently allowed interference budget, reducing the budget available for AWS-3 licensees. Any such reduction would limit the number of AWS-3 mobile devices that could operate in and around the coordination zones, negatively affecting the utility and efficiency of the AWS-3 spectrum and degrading AWS-3 deployments. This runs counter to the investment-backed expectations of Auction 97 bidders, because the entire interference budget, as contemplated by the CSMAC process, was allocated exclusively to AWS-3 licensees prior to Auction 97.<sup>21</sup>

Due the effects of aggregation, it is very difficult to estimate the precise effect that splitting the current interference budget between AWS-3 licensees and 1675-1680 MHz licensees will have on AWS-3 deployments. However, the simplest case to consider is a 50-50 split. In rough terms, this would require AWS-3 licensees to deploy twice as many base stations in many areas compared to the pre-auction case of AWS-3 licensees having access to the entire interference budget in a given license area. This represents a significant increase in the capital required to deploy an AWS-3 network compared to bidder expectations prior to the AWS-3

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<sup>20</sup> See *Assessment of the Potential for LightSquared Broadband Base Stations in the 1670-1680 MHz Band To Interfere with Select NOAA Legacy Ground Locations*, Alion Science and Technology (February 2014), available at <http://apps.fcc.gov/ecfs/document/view?id=7521098269>.

<sup>21</sup> Moreover, a portion of the proceeds from Auction 97 was allocated to fund certain costs for facilitating sharing of the 1695-1710 MHz band between AWS-3 and Federal Users, such as the cost of relocating radiosondes and adding RF monitoring equipment to Federal Users' earth stations. See *National Weather Service Radiosonde Program Breakdown of Costs*, NTIA (July 2014), available at [https://www.ntia.doc.gov/files/ntia/publications/initial\\_estimated\\_costs\\_and\\_timelines\\_1695-1710\\_mhz\\_band\\_05-12-2014.pdf](https://www.ntia.doc.gov/files/ntia/publications/initial_estimated_costs_and_timelines_1695-1710_mhz_band_05-12-2014.pdf) (showing \$80 million allocated for relocating radiosondes and \$443 million allocated for RF monitoring).

auction. More favorable interference budget splits for AWS-3 licensees (*e.g.*, 90-10, 80-20, etc.) would have a lesser effect on AWS-3 network deployment, but still require more base stations than assumed based on the pre-auction understanding of bidders.

It would be impossible, under the Ligado Proposal, to allocate any of the current interference budget amount to Ligado's proposed use without "stealing" interference budget from AWS-3 licensees who acquired their spectrum at auction on the basis of an interference budget allocation that was codified in the FCC's rules.<sup>22</sup> This diminution in AWS-3 licensees' interference budgets is compounded by the fact that, under the Ligado Proposal, it would be difficult, if not impossible, to distinguish the interference to Federal Users' systems caused by AWS-3 operations from the interference to Federal Users' systems caused by the commercial operations proposed by Ligado in the 1670-1680 MHz band. When there are two potential interfering operators from two different spectrum bands, identifying the offending party is difficult, if not impossible.

Additionally, the nature of interference caused by downlink operations and the nature of interference caused by uplink operations are different, and will require different remediation processes over different time periods. For example, base station operations such as those contemplated by Ligado in the 1670-1680 MHz band are fixed, and as such the interference they produce will be relatively constant during the busiest usage hours. In contrast, interference from mobile devices as prescribed for the AWS-3 band will be more variable and often intermittent, depending on several factors, including the number of mobile devices operating, the RF conditions experienced by each operating device, and the uplink bandwidth needs of each device.

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<sup>22</sup> See 47 C.F.R. § 27.1134(c).

As a result of these concerns, and as outlined in more detail below, the 1675-1680 MHz licensees need to be subject to RF monitoring requirements.

**B. Ligado's Proposal Would Result in Unanticipated Costs to AWS-3 Licensees.**

The Ligado Proposal would change the radio-frequency environment for AWS-3 licensees just one year after the purchase of the licenses. AWS-3 licensees could deploy service under these changed circumstances, but would incur substantial unanticipated costs.

Because there is only 15 megahertz of separation between Ligado's proposed base transmit frequency and AWS-3 licensees' base receive frequency, base station to base station interference is a concern. In this case, Ligado's proposed base station transmissions at 1675-1680 MHz would cause interference to AWS-3 base station receivers at 1695-1710 MHz in many common deployment scenarios. This raises siting issues and could impose debilitating constraints on AWS-3 deployments. For example, co-location of 1675-1680 MHz licensee and AWS-3 licensee base stations on the same tower or rooftop would require adequate vertical separation in order to prevent interference. If the required vertical separation were not possible, the only solution would be to install external filters at the victim AWS-3 base stations, adding cost to, and reducing the performance of, AWS-3 operations.<sup>23</sup> Similarly, and worse, the location of each provider on sites in close proximity to one another would pose problems for AWS-3 licensees. This is of particular concern in urban areas where site spacing is densest and site grids of operators do not always align, which increases the probability that sites of different operators will be in close proximity to one another. In addition, there is a reciprocal issue concerning AWS-3 mobile devices causing interference to nearby 1675-1680 MHz devices.

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<sup>23</sup> Specifically, even if the rules require very strict out-of-band emission limits on base transmissions in 1670-1680 MHz, receiver overload caused by in-band power is still possible, and the solution would likely require a modification of the victim AWS-3 base station.

However, assuming no modifications to AWS-3 devices are made, any potential interference from AWS-3 licensees in which such devices would be the victim would be probabilistic and transient in nature, whereas the base-to-base interference in which AWS-3 licensees would be the victim would be deterministic and more persistent.

The international standards body, 3GPP, typically imposes standard coexistence criteria for both base stations and mobile devices so that new 3GPP band classes protect each other from harmful interference. The standard value for mobile device transmissions into a neighboring band is -50 dBm/MHz, while the standard value for base stations is -49 dBm/MHz. With just 15 megahertz of separation between the 1675-1680 MHz and AWS-3 bands, neither of these standards could be met without additional filtering. However, filters require power and space, so filtering transmissions from a base station is much less problematic than filtering transmissions from handheld devices. Filtering also adds cost to each device as well as to each base station. Considering that the number of base stations in a nationwide network is several orders of magnitude smaller than the number of handheld devices, the cumulative financial impact on device cost is substantially greater. Filtering also requires more power, which reduces battery life in handheld devices, but has a minimal effect on the operational expense for base stations.

Further, often when bands are very close spectrally, achieving the required emission levels from mobile devices into a neighboring band is not possible with filtering alone, and another method called Additional Maximum Power Reduction (“A-MPR”) must be used. A-MPR is enabled in software, but it can severely reduce the performance of the network’s uplink operations, which would require the operator to deploy (and pay for) more sites.

In short, without relaxation of the standard 3GPP coexistence specification, AWS-3 mobile devices and networks would incur substantial costs to coexist with commercial downlink

operations in 1670-1680 MHz. 3GPP has recently ratified Band Class 70, which pairs the 1695-1710 MHz uplink band with the 1995-2020 MHz downlink band, and the Ligado Proposal sets the stage for a future issue in the 3GPP standards process in which 1675-1680 MHz licensees insist upon standard 3GPP coexistence protection of their band from Band 70 mobile devices. While the FCC can specify out-of-band emissions from base stations to be consistent with 3GPP coexistence specifications by requiring transmissions in the 1675-1680 MHz band to meet  $79+10*\log_{10}(P)$  at the AWS-3 band edge,<sup>24</sup> relaxation of the 3GPP mobile coexistence requirement would be an industry decision and there is significant risk that these requirements would not be relaxed. SNR and other AWS-3 licensees could not have anticipated these issues when bidding in Auction 97. Accordingly, if the FCC adopts the Ligado Proposal, it should require the commercial 1675-1680 MHz licensees to absorb the direct and indirect costs that their use of the 1675-1680 MHz band will impose on AWS-3 licensees.<sup>25</sup> This would encourage 1675-1680 MHz licensees to relax the 3GPP mobile coexistence requirement for coexistence with Band 70 and ensure that commercial operations in the 1675-1680 MHz band do not affect the investment-backed expectations of AWS-3 licensees for the use of their spectrum.

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<sup>24</sup> Measured in a one megahertz bandwidth. In the past the FCC has taken similar steps to protect uplink bands from out-of-band emissions from neighboring downlink bands. *See, e.g., Service Rules for Advanced Wireless Services H Block—Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1920 MHz and 1995-2000 MHz Bands*, Report and Order, 28 FCC Rcd 9483 ¶ 60 (2013) (“*H Block Order*”) (requiring base station transmissions in the H block (1995-2000 MHz) to be attenuated by  $70+10*\log_{10}(P)$  into the 2005-2020 MHz band to protect the AWS-4 uplink).

<sup>25</sup> *See, e.g., Amendment of Section 2.106 of the Commission’s Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service, et al.*, Third Report and Order and Third Memorandum Opinion and Order, 18 FCC Rcd 23638 ¶ 9 (2003) (requiring new licensees in a band that benefitted from the relocation of incumbent licensees out of the band to share the incumbents’ relocation costs).

**C. Any 1675-1680 Licensees Should be Subject to the Same Coordination and Monitoring Requirements as AWS-3 Licensees.**

If the Commission adopts the Ligado Proposal it should require that licensees in the 1675-1680 MHz band complete the same coordination processes as the AWS-3 licensees and be subject to the same monitoring requirements. This would protect all affected spectrum users and ensure that the 1675-1680 MHz licensees are accountable for their use of the spectrum.

Specifically, SNR recommends that any new 1675-1680 MHz licensees undertake a three-step process. First, as suggested above, the licensees should engage with the Federal Users to secure approval to increase the applicable interference budget. Second, the licensees should go through the CSMAC process to determine protection criteria and coordination zones, taking into account the allowable increase of interference budget determined in Step 1. That process, described in more detail in Section III.A above, addressed potential interference issues for the AWS-3 licenses and has the additional benefit of allowing broader industry participation. Finally, the 1675-1680 MHz licensees should be subject to the same RF monitoring required for AWS-3 licensees.<sup>26</sup> Moreover, 1675-1680 MHz licensees should pay any costs associated with each of these processes, including the costs to expand the currently proposed RF monitoring system to include the monitoring of base station transmissions from the 1675-1680 MHz band and to distinguish these transmissions from AWS-3 uplink transmissions so that the respective interference budgets can be monitored and enforced independently. This three-step process

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<sup>26</sup> *Amendment to the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, Report and Order, 29 FCC Rcd 4610 ¶ 19 (2014) (stating that for AWS-3 licensees, "Federal incumbents plan to develop and deploy real-time spectrum monitoring systems for the 1695-1710 MHz band. We will also require that uplink/mobile devices be under the control of, or associated with, a base station as a means to facilitate shared use of the band and prevent interference to Federal operations.").

would apply the same rigor to the allocation of the 1675-1680 MHz band as was applied to nearby bands, and thus protect the efficient operations of all affected spectrum users.

#### IV. CONCLUSION

In initially making its proposal, Ligado indicated that its proposed additional use of the 1675-1680 MHz band should “be permitted only if such use is coordinated to protect government systems that will remain in that band.”<sup>27</sup> Under FCC policy these same protections must be afforded to incumbent commercial operators as well.<sup>28</sup> As demonstrated above, the Ligado Proposal presents significant problems for the Federal Users in the band, as well as for the commercial licensees operating in nearby bands. Under the Ligado Proposal, the cost to address these problems would be disproportionately borne by AWS-3 licensees, frustrating their legitimate, investment-backed expectations. These issues should be seriously examined by the Commission before it moves forward on any aspect of the Ligado Proposal. If the FCC approves the Ligado Proposal, SNR respectfully requests that the 1675-1680 MHz licensees absorb any costs incurred by AWS-3 licensees as a result. The Commission should additionally require 1675-1680 MHz licensees to complete the same coordination processes and be subject to the same monitoring as AWS-3 licensees.

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<sup>27</sup> *Ligado Petition* at 1.

<sup>28</sup> See, e.g., *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Small Entity Compliance Guide, 30 FCC Rcd 9742 (2015) (providing the highest levels of protection to federal and commercial incumbents in a spectrum band); *Amendment of Part 2 of the Commission’s Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, Ninth Report and Order and Order, 21 FCC Rcd 4473 ¶ 46 (2006).

Respectfully submitted,

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